

4F Crops
Kick-off meeting
01/07/2008
Brussels
Dr Georgios Kitsios

Who we are

Participant AUA.bio



- A state-supervised higher education and research organization
- Multi-discipline research (Plant science, Food science, Animal science, Agricultural economics, Rural development)

Who we are

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Plant Molecular biology group

Research experience

- Plant molecular biology
- Genetics
- Developmental genetics
- Cultivar identification
- Discrimination-genetic mapping & relationships

Research interests

- i. Molecular mechanisms underlying cell differentiation
- ii. Plant stress mechanisms
- iii. Genetic mapping & cultivar discrimination of olive
- iv. Biological aspects of oil biosynthesis in olives

Work Package 2: Cropping possibilities

Objectives: To assess the cropping possibilities of the non-food crops in the existent agricultural systems. Parameters that will be investigated will be the choice of the crops, the rotation possibilities, the yields per unit of land area, the desirable raw materials characteristics as well as **the role that the biotechnology will play on the further yielding improvement.**

Task 2.5 (AUA.bio) : Biotechnological improvement

Description:

- An inventory of the current state of art of the generic tools currently available for the non-food crops of interest.
- This knowledge-based approach will provide potential improvements to selected non-food crops.
- At the same time, lack of knowledge can be identified and future research questions to be defined.

People involved: Dr. Dimitra Milioni, Dr
Stamatis Rigas, Dr. Georgios Kitsios

Crop improvement and Biotechnology

Reasons:

- Plants are a great part of our economic prosperity (food, feed, fiber, biofuels)
- Europe is facing the challenge to provide sustainable, safe, high quality and health promoting products

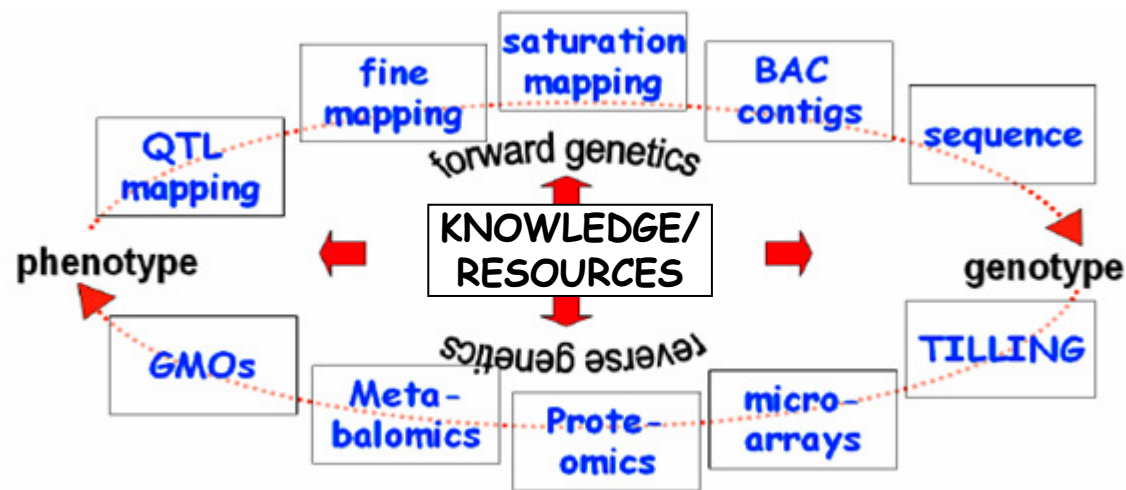
Obstacles:

- Germ plasm in short supply
- Slow traditional breeding, selection and hybridization techniques
- Breeding experience is restricted to major crops

New biotechnological routes for crop improvement through the production of both non-genetically modified (non-GM) and GM plants.

Task 2.5 (AUA.bio) : Biotechnological improvement

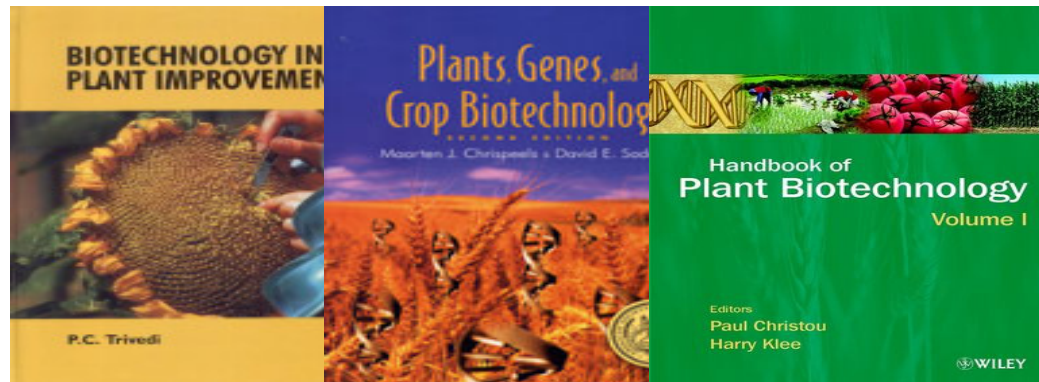
Build upon the present knowledge base



- Exploit the knowledge and resources produced previously
- Understand the genetics of selected agronomical traits
- Identify possible biotechnological applications for non-food crop improvement

Resources: Literature

Scientific review papers, articles and books



State organizations / biotech companies



Resources: web

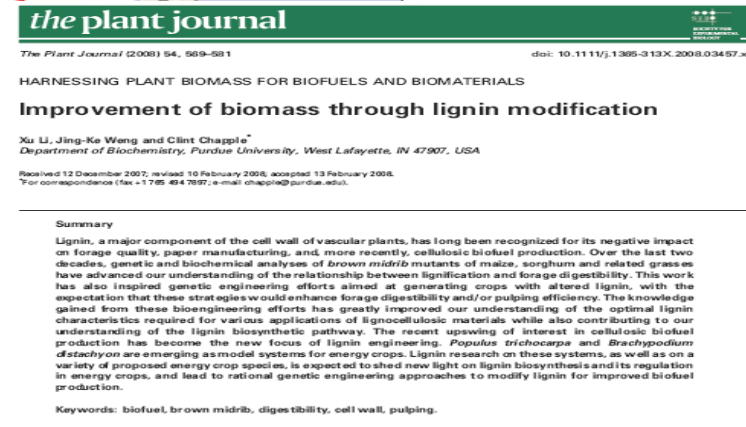
Conduct Electronic Literature Searches



Search database

Query Pubmed

Check article abstract, then full paper if interesting



Introduction

The exploitation of fossil fuels during the global industrialization of the past century has propelled development of the world economy. As the demand for energy continues to surge in the 21st century, societal concerns about soaring oil prices, global warming due to greenhouse gas emissions, and energy security are prompting policymakers and scientists to explore the feasibility of renewable, sustainable biofuels as alternatives and/or supplements to petroleum-based fuels (Kerr and Service, 2005; Koonin, 2006; Schubert, 2006). The biofuels currently available on market, mainly ethanol and biodiesel, are predominantly produced from corn grain, sugar cane and soybean oil. According to recent statistics, approximately 5 billion gallons of corn ethanol were produced in the USA in 2006, which is equivalent to only 3.6% of the total volume of gasoline consumed in that year. Similarly, the 100 million gallons of biodiesel produced in the USA in 2006 accounted for <0.2% of the total diesel used domestically (Yacobucci and Schnepf, 2007). To achieve a substantial substitution of gasoline by biofuels, it has been proposed by many that lignocellulosic biomass from a variety of sources, including agricultural residues such as corn stover and sugar cane bagasse, trees and grasses, is a potential source for 'cellulosic ethanol' (Demirbas, 2005; Lynd *et al.*, 1991; Somerville, 2006, 2007; Wang *et al.*, 1983). Cellulose from plant materials has already played many important roles in human history: cotton fiber is used for cloth making, paper is made from cellulose fibers extracted mostly from wood, and cellulose is also the major nutritional component in forage crops for ruminant livestock. Indeed, a large proportion of the population of the developing world depends not upon oil but upon wood for their energy needs (Madubani and Shackleton, 2007). If we can find a way of efficiently converting cellulose from plant biomass into liquid fuels, it will provide humans with a renewable and carbon-neutral energy source for future sustainable development.

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Resources: Electronic databases



Query database

Research Interest

User Services

Search Website

Home

Genomics

Mapping

Germplasm

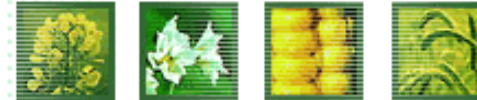
Pathology

Taxonomy

<http://grain.jouy.inra.fr/ggpages/index.shtml>

gabi
PD

GABI Primary Database
Max-Planck-Institute of Molecular Plant Physiology
Potsdam-Golm



<http://gabi.rzpd.de/index.shtml>

WHEAT GENOME DATABASE



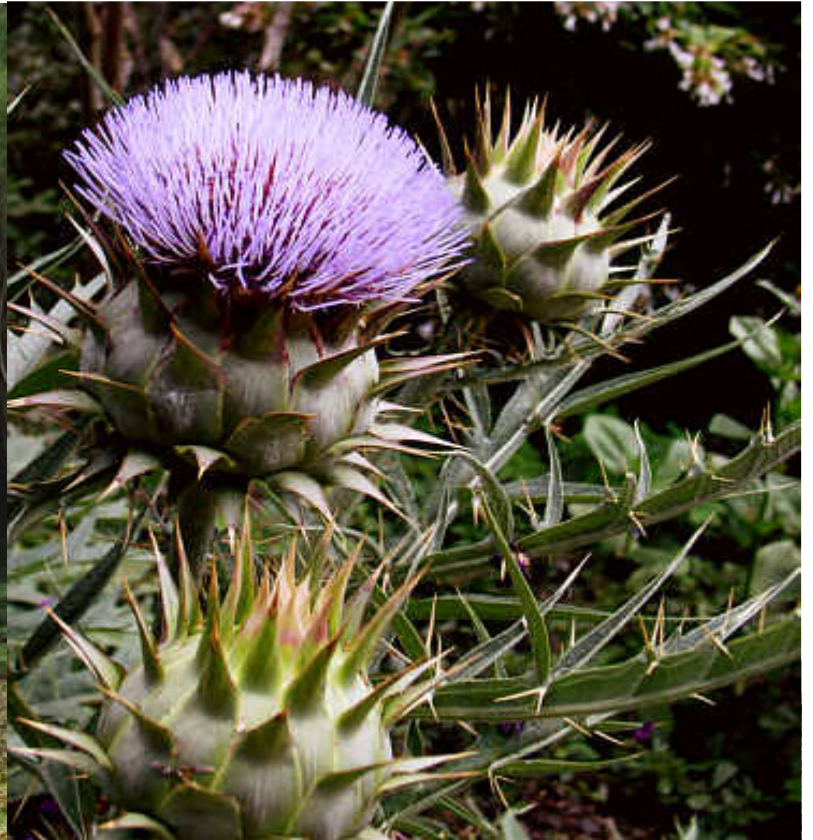
<http://www.tigr.org/tdb/e2k1/tae1/>

Deliverables

The output of AUA.bio will not be cultivars

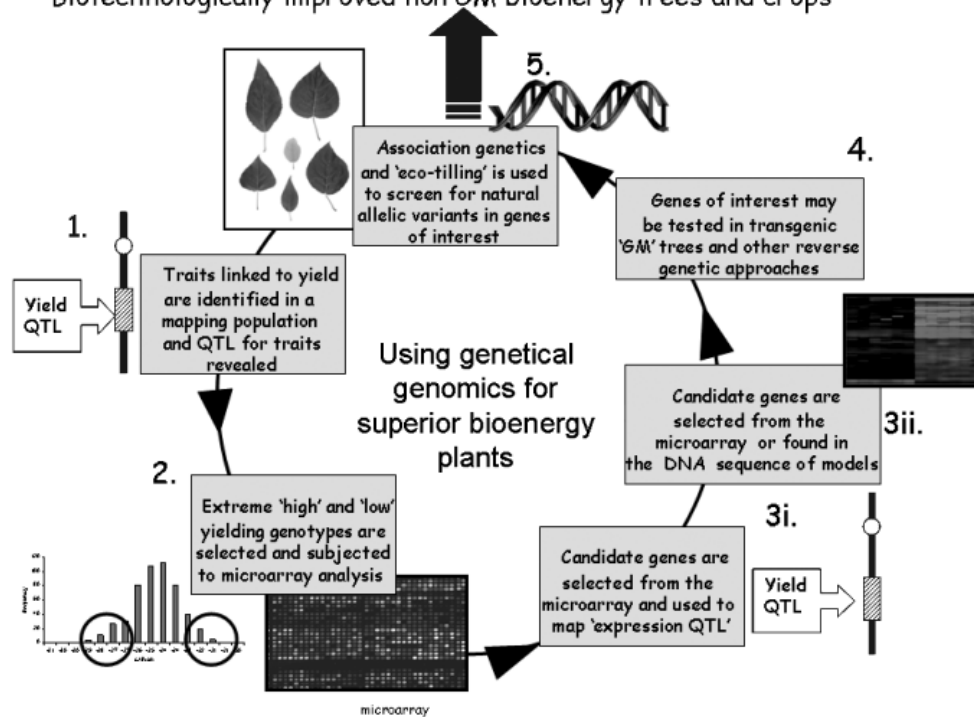
but

to identify resources and tools-markers, plant genotypes and the understanding of the genetic control of relevant traits- that can be exploited in strategies for non-food crop improvement, consistent with 4F Crops objectives.

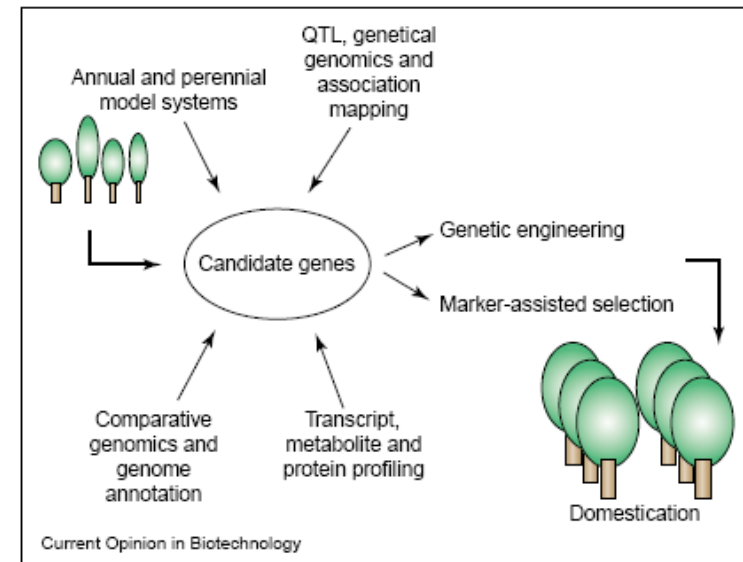


Crop improvement and Biotechnology

Biotechnologically improved non GM bioenergy trees and crops



Sims *et al.*, 2006



Boerjan *et al.*, 2005

Crop improvement and Biotechnology

Table 1

Forest tree genomics databases.

| Species | Feature | Link |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Eucalyptus</i> spp.; <i>Picea</i> spp.; <i>Pinus</i> spp. <i>Robinia</i> spp., <i>Populus</i> spp. | EST | http://web.ahc.umn.edu/biodata/ |
| <i>Picea</i> spp.; <i>Populus</i> spp. | EST | http://www.arborea.ulaval.ca/en/ |
| <i>Pinus</i> spp. | EST | http://www.pierroton.inra.fr/Lignome/ |
| | EST | http://pinetree.ccgb.umn.edu/ |
| | EST | http://fungen.botany.uga.edu/Projects/Pine/Pine.htm |
| | EST | http://cbl.labri.fr/outils/SAM/COMPLETE/index.php |
| | EST | http://www.cbc.umn.edu/ResearchProjects/Pine/DOE.pine/index.html |
| | Protein database | http://cbl.labri.fr/outils/protic/ProticDB.php |
| <i>Populus</i> spp. | EST | http://Poppel.fysbot.umu.se |
| | EST | http://www.populus.db.umu.se |
| | EST | http://sputnik.btk.fi/project?name=Populus%20euphratica |
| | EST | http://www.aspendb.mtu.edu/ |
| | EST | http://mycor.nancy.inra.fr/poplardb/index.html |
| | Microarray analysis | http://www.upsbase.db.umu.se/ |
| | Genome sequence | http://genome.jgi-psf.org/Poptr1/Poptr1.home.html |
| | SSR resource | http://www.ornl.gov/sci/ipgc/ssr_resource.htm |
| Science Plan | http://www.ornl.gov/sci/ipgc/the_populus_genome_science_plan.pdf | |
| All forest tree species | General | http://dendrome.ucdavis.edu/index.html |

Boerjan *et al.*, 2005